Early results of external iliac artery stenting combined with common femoral artery endarterectomy

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Purpose: **The endovascular approach to external iliac artery (EIA) disease extending into the common femoral artery (CFA) has been avoided because of problems with stent placement across the inguinal ligament. Surgical treatment for this disease distribution includes extensive endarterectomy or bypass procedures or both. We report our initial experience with a combined open and endovascular approach to these patients.**

Methods: **We performed a retrospective analysis of all patients who underwent intraoperative EIA stenting after CFA endarterectomy/patch angioplasty between 1997 and 2000. Stents were positioned to end at the proximal endarterectomy endpoint, without crossing the inguinal ligament. Technical success, hemodynamic success, and clinical success were determined according to Society of Vascular Surgery/International Society of Cardiovascular Surgery criteria. Life-table analysis was performed for patency.**

Results: **Thirty-four patients (mean age, 68 years; 23 male, 11 female) had combined endovascular and open treatment of iliofemoral occlusive disease. Indications were claudication in 41% and critical limb ischemia in 59%. Femoral reconstruction included endarterectomy with patch angioplasty in all patients. EIA stent deployment incorporated the stenotic iliac segment and the proximal endpoint of the endarterectomy in all patients. Four patients (12%) also needed common iliac angioplasty at the same time for proximal iliac disease, and 14 patients (41%) also needed distal revascularization for associated femoropopliteal or tibial disease. Technical success and hemodynamic success were achieved in 100% of patients. Clinical success was achieved in 97% of patients. The mean postoperative increase in ankle-brachial index in patients with inflow procedures only was 0.36 (range, 0.1 to 0.85). The overall complication rate was 15%. With a mean follow-up period of 13 months (range, 0.5 to 28 months), 1-year primary patency and primary-assisted patency rates were 84% and 97%, respectively. No perioperative mortality was seen.**

Conclusion: **EIA stenting as an adjunct to CFA endarterectomy/patch angioplasty allows for more localized surgery than conventional bypass. This approach also allows a better interface between the stent and endarterectomy than staged preoperative stenting. Technical success and early patency rates are excellent. (J Vasc Surg 2002;35:1107-13.)**

The use of endarterectomy for occlusive disease of the common femoral artery (CFA) has been standard practice for more than 50 years. Patch arterioplasty with either autogenous vein or more recently prosthetic patch material is generally used and is usually performed to provide inflow in concert with femoral-distal bypass or femoral-femoral bypass. This approach provides satisfactory results in cases of focal disease limited to the CFA and proximal superficial femoral artery and profunda femoris artery. Cases in which the diseased segment extends proximally into the external iliac artery (EIA) present a more complex problem. The best approach to complex iliofemoral disease is controversial.[1,2] Conventional approaches include extension of the exposure proximally with division of the inguinal ligament and extensive endarterectomy, separate transperitioneal or retroperitoneal exposure, and more extensive aortofemoral or iliofemoral bypass, femorofemoral bypass, or contralateral iliofemoral bypass.[3-8] These options carry with them increased cardiopulmonary stress as the result of a more extensive procedure and increased risk of complication, such as femoral hernia or lymphedema.

Since the American Heart Association multidisciplinary advisory committee report in 1994 suggesting bypass procedures to be superior to angioplasty/stenting for aortoiliac disease, we and several other groups have published results for the use of interventional approaches for multisegment iliac occlusive disease.[9-18] These groups have reported patency rates of 55% to 77% for iliac angioplasty and stenting, with assisted patency rates of nearly 90%, with close follow-up and reintervention. The success of intervention is dependent on the indication, gender, runoff, lesion severity, and lesion location. The presence of EIA stenosis is a predictor of poor outcome, and its severity can be used to stratify patients with multisegment disease and predict the durability of endovascular treatment.[9] Endovascular treatment has become standard for patients with focal common iliac disease, with long-term patency rates of 70% and clinical success rates in excess of 90%. Focal EIA disease is less well studied, but reports suggest excellent results,

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with clinical improvement in this group as high as 98%.[14] Extension of stenting across the inguinal ligament to incorporate CFA disease results in significantly poorer outcomes because of damage of stents across a moving joint and an increased development of intimal hyperplasia at these locations.[19,20]

Combined open and endovascular approaches to complex vascular disease that does not conform to one treatment approach are becoming more common as more vascular surgeons have endovascular skills and results of procedures performed in the operating room are favorable.[21,22] The purpose of this study was to examine the efficacy of a combined open and endovascular approach to patients with long segment iliofemoral occlusive disease with CFA endarterectomy and patch angioplasty with EIA stenting.

METHODS

Between April 1997 and November 2000, 34 symptomatic patients underwent CFA endarterectomy with patch angioplasty and EIA angioplasty with primary stenting in a single combined open and endovascular procedure for treatment of extensive iliofemoral occlusive disease. Retrospective review of the patient charts, duplex ultrasound scan findings, angiogram results, operative findings, and procedural details was performed.

All patients underwent preoperative evaluation for peripheral vascular symptoms with duplex ultrasound scan examination. This included evaluation for iliac arterial disease and ipsilateral runoff at least to the popliteal artery. Patients with evidence for significant CFA occlusive disease with proximal extension into the EIA were considered for combined CFA endarterectomy and patch angioplasty with EIA stenting. Preoperative or intraoperative arteriography was performed to confirm these findings and further direct treatment. The presence of significant *CFA/EIA disease* was defined by an absent femoral pulse, a more than 2.5× peak systolic velocity step-up across the diseased CFA segment with duplex scan with more than 50% luminal narrowing with B-mode imaging, a more than 50% diameter reduction with angiographic imaging, or a more than 10 mm Hg systolic pressure gradient across the distal EIA at the time of intraoperative angiography. Patients with concomitant severe superior femoral artery or distal disease underwent simultaneous CFA endarterectomy/patch, EIA stent, and distal bypass.

Operative procedure for CFA endarterectomy followed the standard accepted technique. CFA was identified at the inguinal ligament, the ligament was left intact, and exposure was carried down to the femoral bifurcation. Puncture of the CFA was performed to establish guidewire access across the iliac lesion into the abdominal aorta with fluoroscopic guidance. Longitudinal arteriotomy was created, and standard subintimal endarterectomy was performed, with the distal endarterectomy ending as a fine tapering of the CFA lesion into the superior femoral artery or profundus femoris artery and the proximal endpoint cut flush just proximal to the inguinal ligament with no attempt to endarterectomize the more proximal EIA. Patch angioplasty then was performed with a standard elliptical Dacron patch and running sutured anastomosis. Before completion of the patch angioplasty, the patch was punctured in the center with an 18-gauge needle, and the guidewire was brought out through the center of the patch. After the patch angioplasty was completed and flow was restored, a 7F short sheath was placed over the wire and through the center of the patch. If guidewire access could not be obtained initially with puncture, it was then attempted after arteriotomy but before endarterectomy, and finally, if necessary, after endarterectomy with direct vision. In cases in which the guidewire could not be passed retrograde through the arteriotomy, a percutaneous approach from the contralateral femoral artery was used and the EIA segment crossed antegrade by traversing the aortic bifurcation. The guidewire then was snared and brought out through the sheath placed through the patch. Intraoperative arteriography then was performed with pressure measurement across the EIA stenosis. Arterial diameter measurements and measurements of the lesion were made after standardizing the measurement software with either a marker catheter or measurement of the sheath diameter. Primary stenting with an appropriately sized self-expanding, or less commonly balloon-expandable, stent (Wallstent or Symphony nitinol stent, Boston Scientific, Boston, Mass; Palmaz stent or Smart stent, Cordis, Miami Lakes, Fla) was performed. Self-expanding stents were oversized by 2 mm compared with either the normal appearing proximal EIA or the contralateral EIA. Predialation was not performed to minimize embolization risk. The distal endpoint of the stent was just distal to the proximal endarterectomy ledge but above the inguinal ligament and encompassed the proximal tip of the Dacron patch. Poststent balloon dilation was used at the surgeon's discretion for residual luminal narrowing after stent placement or if a pressure gradient of more than 10 mm Hg existed after stent placement.

Technical success was defined as complete resolution of the stenosis angiographically and an unenhanced systolic pressure gradient less than 10 mm Hg across the treated distal EIA segment. *Hemodynamic success* was defined as an increase in the ipsilateral ankle-brachial index (ABI) of at least 0.1, according to the Society for Vascular Surgery/American Association for Vascular Surgery reporting standards.[23-25] *Clinical success* was defined with the American Heart Association (AHA) classification (Table I).[26]

In this study, *patency* refers to the status of the EIA stent segment and the CFA endarterectomy. It does not refer to patency of femoral-distal bypass grafts in patients who underwent additional revascularization. Postoperative assessment of EIA stent patency began with evaluation for recurrent symptoms, physical examination of an ipsilateral femoral pulse, and segmental Doppler pressure recordings with ABI. Patients who remained asymptomatic, had a normal femoral pulse, and had a stable ABI were considered to have a patent EIA/CFA. Patients with recurrent symptoms, a diminished femoral pulse, or a reduction in the ABI

Table I. American Heart Association guidelines for clinical improvement

Grade	Clinical description
3	Markedly improved; ABI >0.9
2	Moderately improved; ABI increase >0.1 but not normal, and increase by one category
1	Minimally improved; ABI increase >0.1 but not normal, or increase by one category
0	No change
–1	Mildly worse; no category decrease but ABI increase <0.1
–2	One category worse or unexpected minor amputation
–3	More than one category worse or unexpected major amputation

of more than 0.15 underwent duplex ultrasound scan examination to evaluate for patency or restenosis of the EIA/CFA. A localized peak systolic velocity increase of more than 2.5× was considered evidence for recurrent stenosis. The decision for repeat endovascular intervention for EIA stenosis was at the discretion of the vascular surgeon. *Primary patency* was defined as patency of the EIA/CFA without evidence for restenosis or requirement for reintervention, and *primary-assisted patency* was defined as a patent artery that needed at least one repeat endovascular intervention to treat a recurrent stenosis. *Failure* was defined as the development of recurrent stenosis or occlusion not amenable to endovascular reintervention.

Statistical analysis was performed with a computer-based statistical software package (StatView, Abacus Concepts, Inc, Berkeley, Calif). Patency rates were calculated with the Kaplan-Meier life-table analysis method. Univariate comparison of life-table curves was performed with Mantel-Cox log-rank analysis. Logistic regression and Cox proportional hazards model were used to evaluate factors associated with procedural failure. Statistical significance was assumed for a P value less than .05.

RESULTS

Complete data were obtained for all 34 patients who underwent combined CFA endarterectomy and EIA stenting during the study period. The demographics of the study group are shown in Table II. The group was two-thirds male, with a mean age of 68 years and a high incidence rate of coronary artery disease, smoking, and hypertension. Relatively few patients had diabetes, and no patient was hemodialysis dependent. In 14 patients (41%), the indication for operation was claudication, and the remaining 20 patients (59%) had critical limb ischemia (10 rest pain, 10 tissue loss).

In all patients, CFA endarterectomy was necessary because of severe bulky disease or occlusion, and EIA stenting was performed for the proximal extension of the plaque in lieu of extending the endarterectomy. The mean length of the EIA/CFA lesions was 5.0 ± 0.6 cm. The breakdown according to the AHA classification was grade 1 (<3 cm), 18%; grade 2 (3 to 5 cm), 32%; grade 3 (5 to 10 cm), 36%; and grade 4 (>10 cm or occlusion), 14%. Fourteen patients

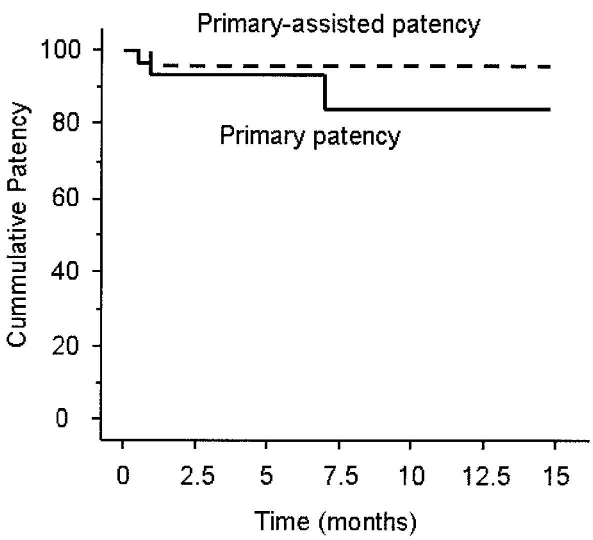
Table II. Patient demographics

Characteristic	*Study group*
Number	34
Gender	23 male; 11 female
Age (years)	68 ± 2 (43-84)
Coronary disease	70%
Diabetes	26%
Hypertension	74%
Smoking	88%
Hyperlipidemia	37%
Renal failure	—
Stroke	—
COPD	37%
Claudication	41%
Rest pain	29.5%
Tissue loss	29.5%

COPD, Chronic obstructive pulmonary disease.

(41%) needed simultaneous femoral distal revascularization for associated femoral-popliteal or tibial disease (10 femoral-popliteal, four femoral-tibial). Four patients (12%) needed simultaneous common iliac artery (CIA) angioplasty for separate isolated but hemodynamically significant stenoses. Nine patients (27%) with critical limb ischemia and the remaining seven patients with claudication underwent CFA endarterectomy and EIA stenting alone. Three of these patients had CFA occlusion. Technical success and hemodynamic success were achieved in 100% of cases. The mean improvement in systolic pressure gradient was 43 mm Hg (45 ± 5 mm Hg preprocedure to 2 ± 0.7 mm Hg postprocedure). The mean number of stents was 1.5 ± 0.1 per patient and included Symphony (76%), Wallstent (12%), Palmaz (8%), and Smart (4%). Symphony stents were used preferentially for the standard retrograde approach. The remaining stents were used to treat the proximal extent of the EIA lesion or were used in cases in which a contralateral approach was used (n = 7; 21%). The overall complication rate was 15%, with two minor wound infections, one perioperative myocardial infarction, one misplaced stent deployed into the CIA, and one proximal external iliac dissection treated via a brachial approach with an additional stent at the time of the primary procedure. No perioperative deaths were seen. One patient died during the follow-up period from complications related to cancer.

Clinical improvement was achieved in all but one patient (97%). According to the AHA classification (Table I),[26] 42% had grade 3 improvement, 35% grade 2, and 20% grade 1, and a single patient (3%) had no improvement (grade 0). No patient's condition was made worse. For the entire group, an overall mean increase in ABI of 0.41 was found. The mean preoperative ABI was 0.38 ± 0.04 (range, 0 to 0.8), and the mean postoperative ABI was 0.79 ± 0.05 (range, 0.28 to 1.1). With exclusion of the patients with simultaneous distal revascularization, the increase in ABI from an inflow procedure alone was 0.36 (0.38 ± 0.07 preprocedure to 0.74 ± 0.07 postprocedure). One patient needed below-knee amputation later in the follow-up period, despite a patent EIA stent, because of



Kaplan-Meier life-table analysis for primary and primary-assisted EIA/CFA patency rates. Primary patency rate depicted with *solid line,* and primary-assisted patency rate with *dashed line.* Standard error was less than 10% for both curves over time period shown.

acute necrotizing foot infection, for a 100% 1-year and a 91% 2-year life-table limb salvage rate.

Primary patency rate of the EIA/CFA, as determined with Kaplan-Meier life-table analysis, was 84% ± 7% at 12 months (Fig). Five patients had recurrent symptoms and a reduction in ABI necessitating percutaneous reintervention at a mean of 7 ± 3 months after the initial procedure (range, 1 to 17 months). The resultant primary-assisted patency rate was 97% ± 3% at 12 months (Fig). Four patients underwent successful endovascular reintervention, but in one patient with a hypercoagulable disorder, the treated EIA/CFA lesion thrombosed, despite reintervention, necessitating femoral-femoral bypass. No difference was seen in primary or primary-assisted patency rates between patients who had or did not have simultaneous distal revascularization. In patients without bypass, the primary and primary-assisted patency rates were 83% ± 11% and 100%, respectively. In patients with distal bypass at the time of surgery, the rates were 85% ± 10% and 93% ± 7%, respectively (P = .92, with Mantel-Cox log-rank test). Similarly, patency rates were no different in patients who did or did not have additional CIA intervention at the original procedure (P = .24). With logistic regression and Cox proportional hazard model analyses, no patient-related factors or lesion characteristics were found to be predictive of EIA/CFA patency. In particular, no difference was found in patency on the basis of EIA lesion classification.

DISCUSSION

We used a combined endovascular and open surgical approach in patients with extensive symptomatic CFA occlusive disease with plaque extension proximal to the inguinal ligament into the EIA. The results of this study showed that this was an acceptable approach, with a high technical and hemodynamic success rate, high clinical improvement rate, high primary and higher primary-assisted patency rates, and a relatively low complication rate. Although this was not a prospective comparison with open extended endarterectomy and patch angioplasty or iliofemoral bypass, these results were comparable with the reported experience with these more invasive procedures. Only five patients (15%) needed reintervention within the first 18 months, and only one patient had an endovascular failure.

The use of a combined approach to lower extremity revascularization is not new. Brewster et al[27] reported long-term results after combined iliac angioplasty and distal reconstruction. They achieved a 76% 5-year patency rate that improved to an 88% assisted patency rate with reintervention. They believed the value of the combined approach was to limit the extent of the surgical operation without compromising the comprehensiveness of the revascularization. Reports of the initial experiences of vascular surgeons with newly acquired endovascular skills describe common iliac angioplasty to treat inflow stenoses proximal to simultaneous femoral-femoral or femoral-distal bypass.[21,28-31] Marin et al[32] have described an advanced approach with placement of an iliofemoral stent graft before distal revascularization with excellent safety and performance results. These various groups have shown that improving the inflow to a femoral-femoral or femoral-distal reconstruction improves ultimate patency and limb salvage of the overall reconstruction. In addition, the necessity of an inflow intervention does not seem to put the distal revascularization at increased risk for failure.[33]

The best treatment for complex iliofemoral disease is controversial, with both open and endovascular approaches having advantages and disadvantages depending on the details of each case.[2] Treatment is best individualized, with its effectiveness dependent on the appropriate preoperative assessment and procedure selection. A combined open and endovascular approach may offer the best features of either approach alone. Less invasive approaches to treatment of EIA extension of occlusive disease combined with CFA endarterectomy have included remote endarterectomy of the EIA from a single femoral exposure.[34,35] Favorable long-term patency rates of 80% to 83% have been reported with low morbidity and mortality rates. Technical failure occurred in 8% of patients as a result of inability to endarterectomize the EIA primarily because of significant vessel calcification. Stents were used selectively on the basis of the result of the endarterectomy. Our results compare favorably with those of these authors.[34,35] Advantages of the approach described in our study with primary stenting without debulking may be improved technical success, less risk of arterial perforation associated with remote endarterectomy, and no apparent limitation because of calcification. Other approaches have used stent grafts for the treatment of iliofemoral occlusive disease.[12,36] Early patency rates of 80% to 85% have been reported, and all cases necessitated distal revascularization. Endoluminal grafting may have the advantage over simple stenting in reduction of intimal hyperplasia,[37] but this approach is still subject to failure as the result of repetitive trauma from movement at the hip joint/inguinal ligament if the stent extends into the CFA. Previous work in a porcine model has shown that stent placement across the joint induces a more virulent intimal hyperplastic response.[19]

Some important technical aspects of the combined open and endovascular approach can be gleaned from our study. The most important technical point is the placement of the guidewire for the interventional component initially before endarterectomy. Early in our experience, we attempted to pass the guidewire retrograde into the EIA after CFA endarterectomy, but this was frequently difficult and unsuccessful and risks EIA dissection. After adopting the approach of retrograde placement of the guidewire before endarterectomy, we have only needed to use a remote access site in cases of EIA occlusion. In cases of CFA occlusion mandating endarterectomy before guidewire access, a planned contralateral approach from the opposite femoral artery is advisable and gives equivalent results. This approach may be limited in patients with bilateral aortoiliac or iliofemoral disease, and a brachial approach might be necessary in this situation. A second technical advantage to the current approach is the superior interface between the EIA stent and the endarterectomized CFA and patch angioplasty. Alternatively, staging the procedures with initial EIA stenting followed by CFA endarterectomy and patch angioplasty would present difficulties with clamping proximal to the planned endarterectomy and with establishing adequate endarterectomy proximally without interference from or damaging of the stent.

The use of self-expanding nitinol stents has several theoretic advantages. These stents are more flexible then balloon mounted stents and do not foreshorten allowing precise placement at the distal endpoint. We have preferred using nitinol stents with radioopaque markers at the ends of the stent. Nitinol stents in general are not as radioopaque as other types of stents, and the radioopaque markers facilitate placement of the stent when using a c-arm fluoroscopy unit.

Combined CFA endarterectomy and patch angioplasty with EIA stenting provides a fairly simple yet effective and durable approach to symptomatic patients with complex iliofemoral occlusive disease. This procedure effectively limits the extent of surgical exposure necessary to provide complete revascularization, resulting in minimal morbidity and mortality. Our short-term results compare favorably with ileofemoral bypass and femoral-femoral bypass. One explanation for the better than expected results of CFA patch angioplasty with EIA stent placement when compared with treatment of isolated EIA lesions with percutaneous transluminal angioplasty/stent is the improved runoff that is likely after CFA patch angioplasty with associated profundaplasty. At present, we reserve aortobifemoral bypass for young healthy patients with diffuse common and external iliac occlusive disease. As vascular surgeons attain greater skill and experience with endovascular techniques, the treatment of more complex vascular disease with a combined open and endovascular approach will become more common.

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DISCUSSION

Dr William Abbott (Boston, Mass). Peter, I would echo what Jim Menzoian said. This is a very fascinating approach, and I really have two technical questions, which if I sat back maybe I would be able to figure out. But would you tell me, number one, why you did the procedures in the order you did—in other words, the endarterectomy and patch first and then the balloon angioplasty stent second?

Dr Peter Nelson. I think the concept there is that you want to create a smooth transition between the stented portion of the lesion and the endarterectomized femoral artery. If you cut your proximal endarterectomy end point flush and then stent across that, I think it creates a smoother transition, whereas if you did it opposite and placed your stent you would be grappling with two issues: one, how to clamp and get proximal control with the stent now in place, and, number two, how to not damage or bend the stent trying to get the last little bit of endarterectomy done.

Dr Abbott. That makes sense. The second question is, how do you get the wire back out through the patch?

Dr Nelson. What we do is, with the patch either free before we start to anastomose or just before we finish the anastomosis, we use the puncture needle to poke through the patch and then advance the wire retrograde out through the needle.

Dr Jens Jorgensen (Portland, Me). It is my understanding that the external iliac occlusive disease is oftentimes a marker for a poor predictor of outcome following angioplasty. Why does it seem to work in this situation?

Dr Nelson. We asked ourselves that same question. As you know, Dr Powell and the group at Dartmouth have spent a lot of time looking at interventional treatment of aortoiliac occlusive disease and have found that external iliac disease is a poor predictor and that you can actually stratify patients based on the extent of their external iliac disease. I think in some way these patients represent a different category of patients. They generally do not have diffuse aortoiliac disease and, for some reason, have focal iliofemoral disease, and often unilaterally. In this particular case, we are as interested as you are as to why the external iliac interventions do so well, whereas if they have diffuse common and external iliac disease, the external iliac disease is the predictor of poor outcome. I think they may be a slightly different patient group.

Dr Andrew C. Stanley (Burlington, Vt). Peter, two quick questions. With a rather extensive groin procedure with a prosthetic patch in there, did you have any infectious complications? Do you have any idea what your complication rate is in comparison with a traditional aortofemoral or iliofemoral?

Secondly, with kind of unilateral disease, do you have any idea as to how many of your patients had prior percutaneous transluminal angioplastys or cardiac catheters before you saw them for their symptomatic disease?

Dr Nelson. To answer your first question, we had a 15% incidence rate of complications, and two of those were minor wound infections. So, yes, wound infections are an issue. They were both limited, not involving patch infection. We did not compare that directly with a subset of patients with aortofemoral or femorofemoral bypass, but it is a fairly low incidence rate of wound problems.

The second answer is that two patients in this study group had previous common iliac artery intervention. I am not aware and I do not have data as to how many had cardiac catheterizations prior to this procedure, but two patients did have previous iliac intervention.

Dr Daniel Gorin (Hyannis, Mass). Two quick questions. I think this is a really elegant approach to this. It is very appealing.

One question is, what preoperative imaging did you routinely use before you took these patients to the operating room? Did they have arteriography, or did you use noninvasive methods?

The second question is technical. At what point did you end the proximal end of your patch and your endarterectomy? Was it right at the inguinal ligament or some distance above it? How low or high did you need to get the end of that stent to make it safe in terms of the groin crease and so on?

Dr Nelson. Thank you. The first question with respect to preoperative workup. All these patients were worked up with both physical examination, ABIs, and preoperative duplex scan. None of the patients had preoperative arteriogram, but all obviously had intraoperative arteriography. That reflects our practice at Dartmouth with duplex scanning aggressively for preoperative evaluation.

With respect to the proximal extent of endarterectomy and patch, it was the purpose of this not to divide the inguinal ligament, and so, by definition, in no patient did that occur. The extent of the arteriotomy and the endarterectomy in the subsequent patch closure was proximal to the inguinal ligament as much as we could retract with a femoral retractor to get up higher, so we did not measure the distance. But you are looking at probably 1 cm of distance above, just so that the external iliac stent could not traverse the inguinal ligament.

Dr Randolph Maloney (Beverly, Mass). Well, I thank you very much for the paper because it is a very useful technique, although my thinking is to do it the other way around. I believe you should establish inflow first. If you cannot get across, then you can always do a retroperitoneal approach or whatever. As a technical aside, I would mention that once you have this stent placed, it is not too hard to extend your endarterectomy a little bit above the inguinal ligament and then under fluoroscopic control know exactly where your stent is. Because if it gets misplaced or requires any dilatation or anything, it can be disastrous if there is a bleed in that area. Having it open, you can control it with in-line balloons, which we do. We will do the stenting first and then do the endarterectomy, controlling the inflow with a Fogarty embolectomy balloon or, if that keeps popping too much because there is a problem with that, you can place a small Foley catheter in which the latex is a little bit stronger and you can still perform your procedure.

I am wondering if you had problems during this time—I saw you came over from the contralateral side a couple of times because you can get through. Did you consider possibly just abandoning and going retroperitoneal to get above the area, which is a pretty simple operation and pretty safe in even a high-risk patient?

Dr Nelson. Thanks. You bring up some good technical points. We did not in any of these patients need to go with a retroperitoneal counterincision to expose that, although obviously that is your ultimate option to achieve proximal control and, even if need be, do an iliofemoral bypass as your backup open procedure. Between the options of direct wire access through the arteriotomy or, as I depicted, a puncture of the common femoral initially, a contralateral femoral artery puncture, and finally the option of a brachial approach, we felt pretty confident that we could in some way attain wire access through the lesion, and so we did not primarily consider to use an adjunctive incision. You do bring up a good point though, and the reason for having other alternatives for wire access is that if you have common femoral occlusion, obviously the puncture option is no longer available. Then you try to open the femoral artery and find the lumen and pass the wire, but that can be very tricky and obviously very risky for dissection of the external iliac artery if you do not get the wire directly within the lumen. That is where a fairly low threshold approach to the contralateral percutaneous approach should be utilized.

Dr Michael Southworth (Somersworth, NH). It is a very appealing approach, but my philosophy is always to think about what you have to do next, and the procedure seems to turn the groin into a fairly hostile environment as far as returning and placing clamps in the future. What is your thought on that?

Dr Nelson. You bring up a good point; however, I think with the configuration that we had on the schematic slide, if these patients, number one, recur, our first approach would be a percutaneous evaluation and probably treatment, as in five patients in this study group. If they ever needed a femorofemoral bypass or an aortofemoral bypass, then in that situation we would probably control our inflow with a balloon, as was pointed out earlier.